Commuting by Car
Weight Gain Among Physically Active Adults

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Background: Prolonged sitting, including time spent sitting in cars, is detrimentally associated with health outcomes.

Purpose: This study examined whether commuting by car was associated with adults' weight gain over 4 years.

Methods: Among 822 adult residents of Adelaide, Australia, weight change was ascertained from self-reported weight at baseline (2003–2004) and at follow-up (2007–2008). Using time spent for car commuting and work status at baseline, participants were categorized as non–car commuters, occasional car commuters, and daily car commuters. Multilevel linear regression (conducted in 2012) examined associations of weight change with car-commuting category, adjusting for potential confounding variables, for the whole sample, and among those who were physically inactive or active (≥150 minutes/week) in their leisure time.

Results: For the overall sample, adjusted mean weight gain (95% CI) over 4 years was 1.26 (0.64, 1.89) kg for non–car commuters; 1.53 (0.69, 2.37) kg for occasional car commuters; and 2.18 (1.44, 2.92) kg for daily car commuters (p for trend=0.090). Stratified analyses found a stronger association for those with sufficient leisure-time physical activity. For non–car commuters with sufficient leisure-time physical activity, the adjusted mean weight gain was 0.46 (−0.43, 1.35) kg, which was not significantly greater than 0.

Conclusions: Over 4 years, those who used cars daily for commuting tended to gain more weight than those who did not commute by car. This relationship was pronounced among those who were physically active during leisure time. Reducing sedentary time may prevent weight gain among physically active adults.

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Background

Prolonged sitting, particularly TV-viewing time, is detrimentally associated with risk biomarkers and health outcomes.[1] This is also the case for sitting while driving or riding in a car. Among adults living in Atlanta GA, each additional hour per day spent in a car was associated with a 6% greater odds of obesity.[2] A cohort study with 21 years of follow-up of 7700 men found that those reporting more than 10 hours/week riding in a car at baseline had 50% greater cardiovascular mortality than those who reported doing so for less than 4 hours/week.[3]

Among the various purposes for car use, commuting is a highly common sedentary behavior for working adults. The proportion of adults who use a car as the main form of transportation to work is 80% in Australia[4] and 86% in the U.S.[5] Car commuting is thus a prevalent risk behavior with public health implications. A cross-sectional study[6] in Texas showed that road distance to work, a proxy measure of time spent in cars for commuting, was associated with higher BMI, waist circumference, and metabolic risk score. However, little is known about the long-term impact of commuting by car on weight change. The current study examined whether commuting by car was associated with weight gain over 4 years.

Methods

Study Sample

Data were from the PLACE (Physical Activity in Localities and Community Environments) study conducted in Adelaide, Australia (population: 1.1 million). Details of study design and sampling procedures have been reported elsewhere.[7] Residential addresses were randomly chosen from 32 urban neighborhoods, which were selected from

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within the Adelaide Statistical Division based on walkability and SES criteria. These neighborhoods had a median size of 116 hectares (interquartile range: 86–228 hectares).

An eligible participant from each address was invited to participate in the study. In 2003–2004, a total of 2650 adults completed and returned baseline questionnaires (11.5% of the residential addresses initially identified); in 2007–2008, the follow-up survey was completed by 1098 adults (41.4% of the baseline participants). The Behavioural and Social Sciences Ethics Committee of the University of Queensland approved the study.

Measures and Instruments

The outcome variable was weight change over 4 years, calculated from self-reported weight at baseline and at follow-up (positive values: weight gain). The exposure variable was the category of car use for commuting to work. The question used to identify car commuting asked only how much time was spent driving a car for commuting on a typical work day, but not how many days per week. Thus, this item was combined with participant's work status to produce a proxy measure for the frequency of car use.

On the basis of the use of a car for commuting and work status (not working, working part-time, working full-time) at baseline, participants were categorized as non–car commuters (those who did not work and those who worked but did not commute by car); occasional car commuters (part-time working car commuters); and daily car commuters (full-time working car commuters). A potential moderator variable was leisure-time physical activity (LTPA), which was assessed (past 7 days) using the long version of the International Physical Activity Questionnaire (IPAQ).[8] Demographic covariates were age, gender, educational attainment, having a child in the household, marital status, and income category. Behavioral covariates included self-reported time spent sitting while watching TV at home and in cars during leisure time (assessed using the previously validated questions regarding the number of days and the average daily amount of time spent in each behavior in the past 7 days[9]) and occupational and domestic physical activities in the past 7 days measured using the IPAQ. Walking for transport, which was assessed also with the IPAQ, was examined as a potential mediator of the relationship between car commuting and weight gain.

Data Analysis

To account for clustering of study participants, multilevel analyses (individuals nested within neighborhood) were used. Linear regression models with random intercepts examined associations of car-commuting category with weight change, adjusting for age and gender (Model 1). Further adjustments were made for other demographic variables (those associated with car-commuting category in univariate analysis) and for the behavioral covariates described above (Model 2).

Baseline weight was not included in the models because adjustment for this factor, which differed among car-commuting categories, could introduce bias into the regression findings.[10] Walking for transport was added separately (after Model 2 was fitted) in order to examine whether this variable attenuated the association between car commuting and weight change. Adjusted mean weight changes were estimated for each commuting category using the covariates set at their mean values.

To test for trend and for interaction, car-commuting category was entered in the regression models as an ordinal variable. Analyses were conducted for the whole sample and for the subgroups stratified by LTPA (insufficient versus sufficient, using 150 minutes/week as the cut-off) on an a priori basis. Data were analyzed in 2012 using Stata 12. The alpha level was set at 0.05.

Results

The final study sample included 822 adults (age range: 20–66 years at baseline), after excluding those with missing values, those who changed their work status between two survey points, and those with extreme weight change values (>20 kg increase or decrease). In comparison to the adult population in Adelaide based on the 2006 Australian Census,[11] the study sample over-represented women, older people, people with tertiary education, and those who were working (Table 1). The overall mean weight gain over 4 years was 1.6 kg. This is consistent with findings from a large-scale population study on Australian adults (annual weight gain: 0.3 kg for men, 0.5 kg for women).[12]

See related Commentary by Marshall in this issue.

Table 2 shows the findings (adjusted mean weight change) of two multilevel linear regression models for the whole sample and the subgroups stratified by LTPA. For the whole sample, there was a marginal trend for the associations of car-commuting category with weight gain in both Model 1 and Model 2. Gender was the only covariate associated with weight change (significantly higher weight gain for women).

Although the interaction for car commuting and LTPA was not significant (Table 2), the sample was stratified by the level of LTPA based on the rationale that those who participate in sufficient LTPA and do not use cars for commuting may gain less weight. Stratified analyses indicated that the effect of car commuting was stronger among those with sufficient LTPA, although the nonsignificance of the tests for interaction suggests that this could be a chance finding. Weight gain was significantly greater than 0 for all of the subgroups, except among those who did not commute by car and engaged in sufficient levels of LTPA. Further analysis in which walking for transport was added in Model 2 found that walking for transport slightly attenuated the association of car-commuting category with weight change, but did not substantially change the findings: p for trend was 0.11 for the whole sample, 0.68 for the group with insufficient LTPA, and 0.041 for the group with sufficient LTPA (weight gain for non–car commuters still not significantly greater than 0).